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Green Issues vs. Greenbacks

Fabian Juers	SkySails GmbH & Co. KG
Christopher May	RedQueen Capital Management
Erick Neuman	ROCHEM
Robert Clarke	Marine Exhaust Solutions

Martin Redmayne

OK. We've built a cushion in for this afternoon; we have a sort of 15 minute window to allow us this flexibility in the programme so everyone will have enough time to make up; we're not going to cut anyone short. If everyone can settle down within the next 2-3minutes it would be great.

This is not necessarily a bragging situation—I've just spent a wonderful holiday in the Maldives recently with my family and I must admit what you see in the ocean there, what you see on the seabed there, when you go diving, is unbelievable. What we're doing to the sea at the moment is quite remarkable. Following that week in the Maldives I then spent 3 days in Viareggio, where I looked into the water and saw a very dark reflection of myself with a very oily swirly pattern and the odd thing floating by. The ocean is a very contrasting place. We have to look after it.

The panel to my right is essentially—their quest is to protect our planet through the yachting industry, through various means, technologies and visions. I'm going to start off the programme immediately by introducing our lead speaker, which will be Christopher May, a Texan, I believe, who has come all the way here to talk about his vision of the green yacht which one day he'll build. And I believe he will, because some of the ideas he has are quite green sky, not blue sky, and I look forward to seeing what he does. We also had Bill Joy from up San Francisco way to talk about his boat Ethereal which has been built in Royal Huisman, again a 95% green project and again groundbreaking and very innovative. The rest of the panel will talk about technology and solutions to the green issues. So I'm going to go straight in to Christopher May to lead the panel.

Christopher May RedQueen Capital Management

Good afternoon ladies and gentlemen. What do Bo Derek the actress and Robert Parker the wine writer have in common? Yes sir, you in the back? Oh I'm sorry, you were just shooin a fly. They both quantified, or attempted to, essentially aesthetic ideals. Derek with her movie 10, a reference to her physique and Parker with wine. I'm proposing that green aspects of yachts become quantified especially diesel water emissions and hull efficiency. However we still have another hurdle which is branding and imaging, a problem similar to what intel faced as the maker of central processing units when PCs took off. Great insight into this problem has been provided by the United States green building council, a Washington DC based non profit comprised of architects, builders, energy and engineering experts and of course lawyers. What they did was so pressing it was to establish an initiative called LEEDS or Leadership and Energy Efficient Design, which is a published tick list of factors necessary to

meet a platinum, gold or energy silver rating. I propose this industry form an organisation roughly analogous to the green building council to do just this. It is true that few yacht charterers or buyers are motivated by energy efficiency at present. However I believe this will change even if only for a new category of yachts, as evidenced by the newly created Mansuro award (The Yacht Report told us about) and in no small part what I read in the broadsheet press. It is also interesting to note that Lloyds also class an extensive list of green aspects but not surprisingly will not rank them as LEEDS does. Reducing the myriad of available technological alternatives such as those represented by the people sitting on this dais with me to an overall effective energy efficiency of platinum, gold and silver means seems to be doing us all a favour. The builder gets to sell a higher value added yacht as these technologies are invariably expensive and make economic sense over a life cycle term, the broker has another good data point that will be good for resale value, the casually interested donor has a feel good—after all he is in the market of perceived value and the requisition of a gold rating should be as effortless as an option on an automobile and a great talking point with his guests and fellow yachtsmen. The only economic argument that can be made to the owner for a near closed water system, scrubbed diesel particularly, it's a more efficient hull design, it can only come from lower operating costs which should imply a higher value of the yacht. Another tremendously bright aspect of going green is that as we begin to change the questions we ask of a yacht, we imply a search for a new standard of beauty. If form follows function then some designer will inherit the mantle just as Herreshoff did for sailboats and Bannenberg did for diesel powered steel yachts. Lastly the political reality is such that the boom in yachts has outstripped the supply of desirable marina locales, which means new marinas capable of handling today's larger yachts which in turn means political savvy. There is no such thing as a politician with a constituency of yachtsmen. Showing the green side of this industry could go a long way to mitigating that fact. Thank you.

Martin

Thank you Christopher. Robert?

Robert Clarke Marine Exhaust Solutions

Thank you to The Yacht Report for this opportunity and thank you to everyone who's here today. The little bit I've heard is that at this early stage there appears to be a bit of a conversion between the commercial aspect of the shipping industry and the yachting aspect, as the yachts get larger and larger. My technology that I'm going to be speaking to you about today is another indication of that conversion. It comes from the commercial shipping side of things and what it is, has to deal with exactly what Christopher spoke about earlier. The greening of the yachting industry. The large yacht industry hasn't been tarred with the same brush that you see in a lot of the press, these are a couple of current headlines with regard to shipping; this comment here was from Bluewater Organisation commenting on the lack of progress at the IMO over green issues and this was from the USA Today broadsheet headline, where we have this general process, or general conception, of the shipping industry as polluting. The reason for this is a number of studies that have come out that actually show this to be the case—this study here, the Port of Los Angeles emissions inventory you can see the dark blue, although it's hard to read this graph, you can take my word for it, represents the ocean going fleet emissions; of course that's residual or heavy fuel burning fleet. The light blue is small harbour craft which would be a distillate burning fleet and the rest of it represents the land sourced mobile bases in and around port. And what's happened is, over the last 30years that these land based emissions, whether it be from mobile sources or power generation or

whatever have done a great job of cleaning up their act. They've really, as you can probably remember, if you're my age, 20 years ago you got behind a City bus and it belched black smoke. Today that City bus is a clean running piece of equipment. So just through the process of their coming ahead and our standing still we're starting to stick out and one analogy I liked was that we're the nail sticking up from the floorboard and there's a regulatory hammer on it's way to tap us back down and get us in line with everyone else. The MEPC, the IMO's marine environmental protection committee has designated the issue to the sub committee on bulk liquids and gases. They are considering a number of proposals to regulate the emissions from ships and again this is particularly relevant to the ocean going fleet. But what's of interest is the severity of the proposals under consideration. This is particularly the US proposal that they've put forward, and they're talking about a reduction of sulphur to 0.1%. Typical residual fuel rate now globally has a sulphur content of 2.7%. We're talking about a 96% reduction. This is not a half way measure. This is full on flat out we're fixing the problem. Similarly for pm, depending on the size of the engine, the reductions you're looking at there are somewhere between 60% down to you have full compliance already with properly tuned common diesels using a low sulphur fuel. So not quite as dramatic but still quite an issue. There are comments that this is more a regulatory sledge hammer, but it needs to be but the general feeling on the political side is that this is an issue we're going to tackle and get ready, because it's coming. The implementation of 0.1% is being called for as early as 2011. I think in reality you may see that date slip a little and it may even go up to 0.5 but there is no question that there is a major shift happening to the ocean going fleet in terms of emissions.

This of course has everyone worried and it's got everybody looking at OK, what can we do. How can we get there. The first option of course is to use a distilled fuel, wow that's expensive. So let's start looking for a technological option. And that's where we come in. Through industry, conferences such as this and some work that's being done by very innovative, very green, shipping companies. You're starting to see stuff that people would have scoffed at ten years ago. The year that you could have a zero emission ship flies in the face of common sense. But there are people out there who are looking at it and saying well, if you want to dream, let's dream big, and this is how we can do it. So when the commercial fleet goes from this type of emission process to clean, the question that we have to ask today here is how does this affect the large yacht industry. It means that there's pressure on for large yachts to go from this type of emission source to this. What you see here is a 68metre superyacht; you've got an exhaust gas scrubbing system on 3 of the auxiliary engines; and you have a near invisible exhaust stream. You get up to 90% removal of the pm10, that's the visible level of the pm between 5 and 10; you get 90% of that out. You get a noise attenuation that acts in effect as a wet muffler, you get a dramatic smell reduction and of course the big question is in terms of operation how much back pressure is this and it's well within the limits. Now the benefits to the yacht owner are he gets to enjoy a dramatically cleaner environment rate on board his ship. He's not going to have soot or particulate matter on his deck, in his drink or an oily sheen in the water but the real value of the system beyond that pleasure and enjoyment is the fact that it does have a significant benefit to the environment and that in itself is where the real value is, particularly in the future, as Christopher mentioned. The real value of this system is going to come in when you go into one of these new marinas and you say hey, I've got a green ship, you'll start to see things like preferential treatment, just the way it's happening right now if you've got a green designated commercial ship you get fairway dues reductions, you get preferred port berthings and I believe you're going to start seeing that coming into the yachting industry. Some of the other issues we just talked about is how complicated these systems are getting and how complex the yachts are. The advantage of this system is it uses existing technology. You've got a sea intake, a water pump that's approximately equivalent to the cooling water

pump for the engine, that water comes up, is delivered to an exhaust water lock where the exhaust actually percolates through the water, it's not a spray, no nozzles. We then have clean cool exhaust and we have transferred the problem to the water. Now up until this point this is no different than a white exhaust. You can go out and purchase a white exhaust and it's absolutely no sort of innovative process. Where we start to get the innovation is that when we come down and take the wash water and we clean it. We put it through a series of two more pumps, actually only one operational and one on inline standby, it goes through a series of hydro cyclones, again a really easy maintenance and operation on these, no filters, no reagents, no chemicals. They take out the soot and the oil, the ash, it goes into a settling tank, you've got the lower bottom of the tank where the heavy stuff settles, the light oils go to the top, it siphons off from there into the vessel's waste oil tank and disposed of ashore appropriately. The clean water from the settling tank goes back into the discharge line, and is discharged overboard. Some of the results we're seeing in terms of oil levels in the discharge water are almost unmeasurable. 0.04ppm is the type of system we're getting. Of course one of the big questions about any technology particularly engine room technology on a yacht is where is the space. These are the sizes in millimetres, for a system that we've just designed into 4 engine rooms for a 4 yacht series being built in Europe, and the engine room design company sat down with us and while we had to pay attention to what we were doing there were no significant headaches in getting the system designed into the yacht. Completely automatic operation, starts up, shuts down, on its own. It's got a monitoring system that allows the crew to understand exactly what's going on, it's got failsafes in terms of plc logic on the valves, and it's also designed so that if anything happens to the water delivery system the ship just runs automatically, no break in any of the engine operations. You just have a dry exhaust at that point.

Maintenance? The only real maintenance issues are with the pump systems and just to note the size, this is for a 1500 kw auxiliary engine on a ferry. The size for a large yacht of course is about a tenth of that. The pump size is certainly something you could pick up in one hand and carry around. The unit itself is made out of superaustenitic stainless steel. This is for corrosion resistance, it's steel that comes out of the flue gas desulphurisation industry, it's got a long and well respected history in being able to handle this type of environment; the piping is blast reinforced plastic, again there's a long history coming out of the petroleum industry for handling the type of materials that we're handling here. This is pretty benign stuff in terms of what the design specs for the materials are. This is the issue that comes back and will be a burden on the yacht owner and more specifically on the chief engineer. We've taken this material out of the exhaust, we're no longer putting it into the ocean, we do need to respond with a responsible method of discharging this and it goes into the settling tank and from there it'll be in the waste oil tank and it can be treated as typical waste oil by any marina, any commercial company that takes care of this. They'll just pump it out and take it away for you. And that's it. I'd like to have any of your feedback and any questions you may have.

Martin

Yes. Eric, thank you very much indeed. We'll go on to Fabian so we can keep the discussion for the end.

Fabian Juers SkySails GmbH & Co. KG

Good afternoon ladies and gentlemen. First of all I would like to thank The Yacht Report for inviting SkySails as we are a very young company from Germany. Today I would like to talk about, very briefly, the new wind propeller system that we

developed. It's based on a towing kite technology and first of all I would like to point out some issues that are very important for, or may become very important for, the yacht industry. It is the rising oil price and declining oil reserves and emission problems of course. Then I would like to propose one possibility, one solution, that would be the SkySails system and just very briefly some advantages and projects we are already doing.

First of all some words concerning declining oil reserves. We see these days the peak of oil production, you can see it here on this graphic, here, maybe we saw it in 2006 or 2007 but anyway we face this problem these days so for any of you who might not be familiar with this peak oil theory it's quite easy to explain. When you pump out half of the oil in one oilfield the pressure within this field drops immediately and what you have to do is to pump down water and after pumping this mixture of water and oil out of the earth you have to separate this, and this will lead to higher production costs. And the other thing is rising problems concerning emissions, and we see that all mature governments talking about this problem already and I have here one example, from the Central Intelligence Agency in the US and you can see nearly everywhere in the world people and governments are talking about this problem, so we see already first, for example in the North Sea we talk about IMO regulations and so on, not to forget the latest IPCC report which addresses as well these problems. And so there's a need for green yachting, definitely. Due to increasing emission regulations this demand is rising. So SkySails is just one opportunity, just one solution, to realise this green yachting. Here is just very briefly the main idea of the SkySails system. We have here the towing kite, by the towing kite and the size, we have it from 40square metres up to 320 square metres. It was originally developed here in the US so it is not something very new, so its technology already existed before we thought about it. You have here the control pod, this actually is the main or the core technology of SkySails. The whole system works totally automatically so no additional crew member on board is needed or extensive training, just very briefly it works by the push of a button and this control pod steering this whole system fully automatically. We have here the towing rope and we have a launch and recovery system with a special winch and an additional mast. The controlling was made by the control system on the bridge. Here I just want to show you a movie.

So you can see the kite is flying here upright in the air, about 200-300 metres above the surface. You can see that it's moving, we are flying the figure of 8, because the power that is generated by flying it in a dynamic mode is much more than it would be if it's stable up in the air. And you can see the pictures we made on the Baltic Sea during last summer with our test vessel. And you can that's already working with auto pilot so there is no-one steering it on the bridge or anywhere. So here we can see an 80 sq metre kite; we are already testing 160 sq metre kites and our first customer from ocean going vessel, commercial vessel they will be equipped with this 160 sq metre kite. OK.

So just a couple of words for the launch and retrieve process. On deck we have a special mast, this mast—you can see it here—it is the heavy duty version for the commercial ocean going vessels but for superyachts it can be folded completely away for example, we can manufacture it out of many materials and you can see here that we have to lift the kite up about 40 metres in the air and you can see that it's reefed together like an accordion, so very little space is required for storing the kites. Then you can see here again the steering unit, the control pod, and the air that comes through these two holes here are inflating the kite until it reaches it's final starting position. And then it will be winched out up to 200 metres and the retrieval process is the other way around. So the system can be used between 3 and 8

Beaufort and safe recovery of course is up to 10 Beaufort and even less than 3. and you can see that you can use it upwind up to 50°; this is due to our dynamic flying mode so it's not like the usual sail. So as I said, all components can be easily integrated into the ship's design; this is what we actually do these days, I will show later some slides with our current project and it's not only for new builds, what we do these days; it's also for retrofitting older yachts. So we're talking about green issues here but there's also another thing, it's the comfort of a motor yacht really is increased by using a SkySail, I want to mention only one thing which is the seagoing behaviour. It is much more stable so the vibration, the whole behaviour on sea, is by far better than the usual motor yacht. You can call it the first hybrid superyacht if you want to. You can use the wind power additionally to the diesel engines but also without and it's also an increase of safety. You can imagine in time of crisis if you are independent from declining oil resources it's a good argument for using wind, not only using SkySails system but also other ideas of course. And yes, if you are afraid to admit that you can always also say that it's a good image, if you protect the climate. So just three slides. Our current projects, our first customer already bought one system for his yacht, it's called Vibella, it's a gentleman from the USA and he lives in France and he currently designs a special superyacht with a length of 40metres for SkySails. And it's the first real hybrid diesel engine superyacht for SkySails. And then a very famous yacht designer, you might know him from England, it's Mr Rob Humphries, he came up with the idea of using kites many many years before we even thought about it but yes, he found the SkySails system was one perfect solution for his idea and for his design, and he designed this 40 metre trimaran which he introduced at the Monaco yacht show last year and these days we are negotiating or you could say planning, it's not even negotiating any more, with a potential customer about realising this project in the future. So this gentleman is really into green yachting, he told me that he bought the latest Lexus I don't know if I can say it here? hybrid car and he's very much into this topic and he said well this is the best idea for yachting that he can think of and we are trying to realise his project also within the next year. One idea for speed, I hope you can see it, you can speed or you can reach a ship's speed up to 20 knots just by using SkySails under perfect conditions of course. That was very briefly and I thank you for your attention and I hope there will be some interesting questions.

Martin

Fabian, thank you very much. Eric?

Eric Neuman ROCHEM

In my presentation I'd like to cover four things. First is I'd like to give you a little insight into the quality of black water sewage and grey waters and the levels of pollutants and kind of how they compare. I'd like to then talk about the existing regulations and where they're going, then give you a quick view at technology that meets stringent discharge requirements and then start the debate and weighing some of the cost benefits of treating both grey and black waters well.

I start out with a question. What are we looking at. I can give you some hints. It goes by many names. It stinks, most people don't want to touch it, a lot of people don't want to talk about it and most people are most comfortable just flushing it and letting someone else worry about it. But getting past the stigmatism of grey and black water, what are we really talking about. What is grey water, what is black water. I'm going to throw some acronyms at you but that's the environmental industry. We over complicate some simple concepts. What we have on board a vessel is black or sewage. You have your grey water sources, your accommodation, which would be

your showers and things. Your laundry, your galley, food waste drainage would be something like water from a pulping system. You have your typical pollution parameters, biochemical oxygen demand, total suspended solids, faecal coliform, chemical oxygen demand, free oil and grease. BOD is a measure of bio degradable organic matter. TSS is fibres, solids, particles, solids that can be filtered out. Faecal coliform is a bacteria but more importantly it's an indicator of other toxic bacteria. COD comprises both bio degradable and non bio degradable oxidisable compounds. And then free oils and grease would be animal fats, lotions, body lotions, cooking oils and things like that. What I want to do is bring your attention to the second column first. If we look at black and the composition of black, these values have been gathered over years on cruise ships but they're really backed up by our experience on mega yachts so the concentrations that you see there and the values are pretty close. Again, we're looking at typical, you're going to see higher and you're going to see lower. But on total suspended solids for black if you compare it to some of the grey waters like galley, it's actually less polluted than a galley would be. And if you think about galley water and how much galley water you have compared with sewage you start to think about the environmental impact of those streams. Because it can be substantial comparatively, compared with the sewage. Faecal coliform we don't have a lot of good data on grey water, how much faecal coliform is in grey water. We have samples from grey water holding tanks and I will tell you that those samples show that they're in the millions. So it can be just as bad as black water. And then if you look at BOD, COD and free oil and grease again comparatively what's worse, some of the grey waters or the black water. If you look at the bottom line, that is domestic waste water. That's what you would find, it's typical concentrations in the sewers outside of the hotel. If you compare that to the average of all the grey and the black water, you see that it's quite concentrated, more polluted than what they typically see out on the street here. And it's simply because there's less water used on board a ship, you're using less water so the contaminants are more concentrated. But they're there. Look at all the zeros there. I want you to pay close attention to the zeros, because now we're going to talk about some of the regulations. And they start to disappear for some reason.

With discharge regulations I think we all agree that we know and we understand that they're getting stricter. I'm not telling you anything new. You see the train that's coming. This is a table of the US and IMO discharge requirements. You have the type 2 discharge requirements, the IMO MSD requirements, if you compare the two you see that there are some differences between this column and this column. These are the existing regulations. The only difference I really would point out that's significant is that IMO regulates BOD and the US doesn't regulate BOD. And it's my opinion but I think it's well substantiated that due to that lack of regulation there you now are living with no discharge zones, because that wasn't controlled, they shut you off, in many, I think we've about 20 states that have no discharge zones. I think in California alone there's 12 or more nowadays. It's hard to keep track because it's a growing number all the time. If you look at the new IMO regulation that goes into effect 2010, you see that IMOs reacting, they see member states lowering the restrictions so they're jumping out front and lowering it. They're trying to control some of the countries that are saying hey, this is enough. You guys are polluting, we're going to have to do something. And so you see that the conventional, they've lowered already. But now they've added COD, chlorine, they've listed chlorine because they had some invisible words previously for chlorine, and also ph, but for the COD I would note to you that, again, as I said that's a total of bio degradable and non bio degradable oxidisable materials. So that will force the industry to choose bio degradable and environmentally friendly products, to be able to meet that in the future. And then you have the restriction on chlorine, which is the typical disinfectant that's been used for many years. The second column that I provide is also of interest

to you because that's the Alaskan cruise ship discharge requirements. EPA did a big study, I think they started out in 2000, they did a ton of sampling aboard cruise ships in Alaska. They sampled both the grey waters and the black waters and based on the results and the level of contamination in both the grey and black waters when they promulgated the discharge regulations in Alaska they regulate both the discharge of grey water and black water. There's no difference. If you want to discharge it you have to treat it to those levels, you have no choice. Otherwise it's not discharged. And that's only—you treat it to that level and then you have certain other restrictions that you have to meet as well. With that EPA study in Alaska, what they also found in doing that, they sampled the raw water but they also sampled the effluent from the MSDs. What they found was that the MSDs that were used in practice were not meeting the current US or IMO requirements. So that industry to meet the existing and future regulations are now installing advanced waste water processes. It's a nice name but it's really something that's been used shoreside for many years, it's been used in the cruise and Naval vessels for 8 years, they've been installed on some of the mega yachts for about 4 years now and so we're really not talking about something that's brand new at this point. As well, when you look at the process, the process isn't that much different than the MSDs. Some of the MDSs that are in use. The differences that you find is that there's a better control system in there to make sure that the system is in proper operation, that you are making clean water and as well, because you're removing more contaminants, you have a more advanced biological system or organic removal system and separation system. Again with the higher level of sophistication and the fact that you're removing more contaminants, the size is going to be larger than what you're used to in the past. And also the price tag for those advantages is going to be commensurately higher. This was like Green Issues vs Greenbacks. I don't believe there's a versus in there. I think one leads to the other, they're not fighting each other. But for this presentation I define green/clean as the use of advance waste water process for the treatment of both grey and black water. You always have your pros and cons. I start with the cons. First thing is cost. Your yacht's going to be marginally higher because of the equipment cost and the space required to install the unit. There's going to be a higher operating responsibility on the people on the vessel, because this unit has indicators that will tell you if it's working. If the captain comes down and he wants to see if the system is running properly it will tell him if the system is running properly. This is not a system that you can put in a compartment underneath the floor of a cabin of a chief engineer and then no-one looks at it except perhaps once or twice a year. It's a system that has to be operated. On the pro side, your yacht is going to have a higher resale value, you have an environmentally advanced treatment unit on there and you market it that way. We know where the regulations are going, the question, not a question, are they going to get there before you do. Having this equipment they don't get there before you do. Ben Franklin had a good quote—drive thy business or thy business will drive thee. I think that's very cutting today, with the previous session. This provides the owner with the pride and confidence that the water quality he is discharging is not degrading the waters around the vessel, this will also help him when he's looking for a marina, or he's looking for flexibility in where he's going to berth the vessel. Preserving and maintaining pristine waters for swimming and recreational use is only going to be a benefit and add to the enjoyable value to the owner, his guests or her guests for now and for generations to come. And you're treating all the water on board the vessel. You're not just treating the black water, but all the waste water. One last quote. Winston Churchill. In conclusion. The price of greatness is responsibility and if you build a boat, a yacht, if you own a yacht, if you operate a yacht you have a certain amount of environmental responsibility. Thank you.

Martin

OK Eric, thank you very much. Thanks to all the panellists. Essentially what we'll do now is have the floor open for discussion on the subject of green issues. We'll have a show of hands for any questions that may come to the floor, I'm sure Holger may not keep quiet for all this session. Yes, thanks, Alan Gilbert in the middle, please, Robin.

Alan Gilbert Gilbert Yacht Design

One observation— I was taken by the kite application; it just seemed to me if we keep making the kites bigger and bigger we can make the engines smaller and we can call it a sailboat! On the issue of, I don't know what to call it, and that's why I'm looking toward you, I've heard people use the expression zero discharge, no discharge; I had a project recently and one of the problems as you know is the states regulate this to a great extent. I spoke to 2 different people at the same coastguard district and one told me zero discharge in this particular area would allow me to discharge grey but not black and the other said you can't discharge anything. So, one, is there common phraseology to straighten out my confusion and—

Eric

I think you're directing that to me?

Alan

Whoever wants to deal with effluence.

Eric

I'll jump right in. I live in waste water! I think the correct terminology, to give you an acronym, NDZ. No discharge zone. And one of the coastguards was correct, although I'll never say that the other one was not correct because I don't know which zone you're speaking of. But the no discharge zone is specifically related to sewage whether it's treated sewage or untreated sewage, you can not discharge sewage. Sewage is black. But it doesn't speak. It's silent on grey water and therein lies the challenge.

Holger Hamann Holger Hamann Consultants

I've actually nothing to say to Eric, I would think so far so good, the point is only for the direction of the bio reactors, what you said, the units are getting big and I believe they are only certain kind of vessels, I would say motor boats about 55metres, 150 feet, will find space for it. But on sailing boats I believe it will be quite difficult. But maybe there's the intention to develop even smaller ones.

Eric

I don't disagree with you. But right now, again, what drives the development is people buying them and right now the people buying them are the mega yachts. But yes, as you make them smaller—they have control systems, you have certain limitations.

Holger

I have a question to Fabian about SkySails. The video that you had, I would like to know the windspeed and the speed of the vessel.

Fabian

The windspeed is about 5 Beaufort and the speed of vessel you saw, it's 55metre long, it was about 5 knots. And it's an 80 sq metre sail.

Holger

And what's going on for example, if you're in the Mediterranean sea and you have said you can run this up to 8 Beauforts? 8 Beauforts in the Mediterranean sea you have quite high waves and I don't know what is happening when the boat goes up and down, what's happening to the sail upstairs? Or what happens to the whole equipment?

Fabian

Actually this is not a problem. Because we are producing also for ocean going commercial vessels and if I think of the North Atlantic Ocean we have the situation quite often. The towing rope, there's a certain damping effect so it is no problem so far.

Holger

But there's a difference on open sea with the waves and the short sea in the Mediterranean. But you have no experience of it?

Fabian

In the Mediterranean no.

Martin

Thank you Holger. Any more questions anywhere? Yes, thank you.

Chip van Gunten Northern Lights

You mentioned, Eric, that the MSDs are getting larger and I was curious, what's the effect going to be on the power usage, generator set sizings and so forth as far as how much power do those systems require?

Eric

Again when we say they're getting larger, their sizing is commensurate with the pollutant load. You're actually removing more pollutants. So your bio reactor as installed, we say is larger but we can also say with the other ones undersized? So it depends on how you look at it. As far as the electrical load, it's about 7Kw per cubic metre.

Eric Goldring

I was wondering, about what percentage is bio filtration as opposed to mechanical filtration.

Eric

I'm sorry I don't understand the question?

Eric G

Well, you can filter effluent two ways. One is as a biological process, the other is mechanical filtering. Are your systems purely mechanical?

Eric

You have certain what they call bio filters. OK. Bio filters could be a large trickling tower that water trickles down through on activated sludge that's on a media. What we utilise is an aerobic reactor with external ultra filtration modules which would be a mechanical filtration.

Eric G

But my question is, I understand you've got both systems working, but how much of it is dependent upon the bio filtration as opposed to polishing it with the mechanical.

Eric

You're doing most of the work biologically. You're removing the organic contaminants with the bio mass in the bio reactor. The ultra filtration provides you with the clarification step and the filtration step to remove any biological matter, bacteria, suspended solids, so all of that is eliminated out of your effluent.

Eric G

Has there been much research in doing, and I don't know, I'm asking, an organo chemical reaction as opposed to more of a biological filtration to reduce the size of the systems ?

Eric

I'm sorry I'm not familiar with that

Eric G

In other words using chemical reactions as opposed to biological processes.

Eric

OK. There has been—what you try to bring is well proven technology. The biological treatment is very good for waste water treatment. Chemical oxidation which maybe what you're talking about has worked effectively in some cases. Chemical oxidation has certain limitations, one you have to add a chemical. Two, you have to meet certain STO isometric requirements. You have A plus B, makes it all go away. And so if you have more A than B, what's happening? Or you have more B than A, then you have the chemical going into the water. And so in the marine experience and in many municipal sewage treatment experiences it hasn't been successful for the varying ability. It can theoretically work, where the chemical oxidation works well is where you have this stream and it doesn't change. And then maybe you take that stream and you put it into a bio reactor just to do some final treatment, and take out any of the hiccups that might come through.

Eric G

I was just trying to think of a way to make the systems smaller, and with the yachts having holding tanks, if there's a way to have a more uniform flow.

Eric

I mean the way you can do that, you can utilise some of your holding tank as your bio reactor, and that gets the bio reactor off the deck. And then you're just dealing with the mechanical filtration steps as well as the pumping and some of the control aspects. It doesn't all go away by any means but you're utilising space inside tanks and things like that so yes, that would be more space efficient.

Mathias Voight

Hamann AG

Just jumping into the discussion. Those organic chemical ways of treatment, they are using engineered enzymes and adding them to the waste water. The problem with that is if you have variations in the hydraulic loads of the different waste water sources, then it's very difficult to dose them correctly and to come up with a result that is suitable for the regulations that Eric has told us about. So it's really more something for land based treatment where you have a constant flow of contaminants and constant hydraulic loads, rather than in the very variable situation on a yacht.

Peter Southgate Cayman Islands Registry

I have a question for Fabian. With the SkySails, what implications, or has any research been done on the implications on stability for example maybe in a gust or squall situation.

Fabian

Yes of course there have been done a lot of investigations because for example our test vessel is class approved and stability calculation is part of that. And even though it's a very new technology there has been no discussion at all and this is also the fact for our first customers from the commercial ocean going vessels, so I can't give you any values right now and any information for any data but of course it must have been class approved, and stability calculations are an important part of it.

Martin

Peter, what do you think?

Peter

Obviously we're looking at a towing situation and if, as my colleague here on my left pointed out, if the line snaps you have the reverse load and particularly if the sail's athwart ships. I mean OK, it's anchored at the bow, but you could still get a tripping moment. For consideration on a Cayman Islands registered vessel I think we'd have to look at those issues quite carefully and I'd be interested in maybe discussing this with Fabian another time afterwards.

Fabian

Yes, definitely. This is a very important topic of course.

Martin

So this is similar to the trawler situation where the overside net tips over? Andy at the back there please.

Andy Stewart Techtonic Design

We design crew areas, galleys, laundries etc. My question is all these regulations that are coming in and people are producing solutions for bio reactors for large yachts, I think the main question that a lot of people have been asking is what about all these 35 and 40metre yachts, all these regulations are going to come in for them as well. How are they going to react to it—are there companies out there bringing solutions in for the smaller yachts so they can retro fit? Or are we only going to be left with large yachts being able provide the solution.

Eric

Well, where there's money, people will come. But the answer is yes, you will have, again, what drives the interest right now is you have the megayachts, at least why I'm here is, you have the megayachts that are investing in these units. Because they see the value of them. The 40metre, and I hate to say it, over the last 5 or 6 years I've only had one inquiry, and that actually was from Bluewater, an environment group for a sailboat. And at that point we didn't have the pieces in place to really support that type of enquiry. But the answer would be yes, there are companies that can support that. What we have, you can continue to downsize, ROCHEM has been in the business for over 30 years, we have over 2000 membrane systems out there from hundreds of cubic metres a day; on these we have ¼ million gallons per day systems. To some of our smaller systems which are in the hundred gallons per day on the smaller membrane systems. So yes, there are solutions. But everything comes in steps. And so yes, that market can and will be satisfied because this isn't rocket science. This is using processes that are currently available and they're just modified for the superyacht industry, the military industry, and put out in a format that meets their needs. As the smaller vessels move in this direction there will be plenty of products to choose from.

Holger

The point is by using a bioreactor is you have to have first prefiltration, because you have to sieve the membranes for fibres and hair so that's already one additional equipment. Then there's just biological law, that you have to have a sufficient height for the ratio, for the bioreactor itself, then of course you have the membrane part in addition. And all this gives the additional space what Eric said. So there's a limitation. I think the point which was discussed when we had the break, also, that if an owner wants to have such a system on a 40metre or on a sailing boat he has to think that he has to make the engine room a little bit bigger. That's just the point. I mean you can have 140metre boat nowadays, it still has an engine room of a 50metre boat. That's the point. They want to have room. But if they want to have more environmental machinery inside they have to increase the engine room. There's no way. That's it.

Martin

Thank you. I think there's a question over here, Robin.

Jeff Bowles Donald L Blount & Associates

To you Robert about the exhaust cleaner. I guess this system is somewhat like an inert gas generator, which is technology that's been around for many years on tankers, so I'd like to see if you can comment on the similarities or what we've learned from the IG systems on tankers in the development of your system. The other thought I had was the examples you put up seemed to be auxiliary engines 200Kws, 300Kws. How big would a system be on a main engine, for example, I know most of our yacht designs use a wet exhaust system so you can keep the volume of the silencer down to a minimum, so we don't impact the accommodations. So I don't know if you could comment on some sizing comparisons if you will, between a system for say a 2Mw diesel and a dry silencer volume or a wet silencer volume.

Robert

You're correct, the system does work similar to an inert gas generator, they're terribly inefficient so one of the challenges we had was how to capture the full exhaust stream into the size of the unit and where most inert generators work with packing towers or sprays we use a water lock system and that gets us the efficiency we need to treat the whole exhaust gas stream. The size issue, what you see there for the auxiliary generators I can stand to be corrected on this but it's my understanding that what we have for auxiliary generators is pretty close in size to existing silencers. We've actually designed systems for 70Kw engine systems, some of the largest engine systems in the world, and I can tell you it's a pretty gigantic silencer by the time you get up to that, just because we have to deal with a large volume of the exhaust gas that we have to keep the velocity down on. But traditionally in a 5000Kw system we're looking at about a 20% penalty oversize from a traditional silencer.

Chris Lloyds Register

I just have some comments for Fabian on SkySails. We were approached a couple of months back and had to deal with a similar type of company that was marketing SkySail type products, and how class would deal with his type of system. And they were looking for type approval of their systems and Lloyds basically told them there was no requirements for type approval on that system. He was just looking for something to make the product more marketable, I guess. But some of the issues that came up when we started to look into the means of propulsion were how he wants to actually, the difference between retrofitting it onto an existing vessel and fitting it onto a new construction vessel and the differences operationally between a commercial vessel and how you would actually market it to a yacht client. From the classification point of view on the structural side we decided to consider the vessel as a sail assisted ship. And Lloyds register has had provisional rules for sail assisted ships out since 1985, I guess mostly from when the windstar vessels came out. One of the biggest issues that we identified from a refit to an existing vessel is that you needed to maintain your design speed and how that design speed relates to the stern frame castings and your rudder design. So from marketing that to a commercial owner for a refit I would think that a commercial owner would want to see his vessel get from point A to point B faster. So he wants to increase his speed. And I think you need to be careful with approaching the commercial end of the market by saying this is going to get you from point A to point B faster. On the other side of the coin you have the yachting industry where you're touting not getting from point A to point B faster but you're touting a more green vessel. You can shut down your engine and run on sail assisted power. So just some point that I'm curious to know, your prototype vessel, what class was it?

Martin

Germanischer Lloyd!!

Fabian

You're absolutely right. As far as I know, I'm not a naval architect, by the way, it's not possible due to the reasons you told us, to increase the ship's speed if you have a fixed design, in that case. And this is what we also recommend for our potential customers. So that's absolutely correct. But for example for new designs, this is definitely possible to adjust the design of the boat or the machinery to the SkySails, but in case of retro fitting, you're right. Definitely. The second thing—

Martin

Am I right in saying, though, Fabian, that this is an additional power source for trans Atlantics, for fuel efficiency?

Fabian

It is for fuel efficiency, and for reducing the emissions on the one side, this is for green yachting. So it is always additionally used to the diesel engine, like a hybrid superyacht. On superyachts you may use it as the only propulsion but I wouldn't recommend that due to the fact that for example the rudder and everything, especially for a superyacht, needs sometimes to work, needs a diesel engine so it is an addition to the main engine. So you can save fuel, you can reduce the emission, and under some you can also think about increasing the ocean going behaviour of the vessel. We've proved that in the ship model basin for example. So these are the reasons for using the SkySails.

Martin

Any further questions? Christopher, which would you have? Power or sail?

Christopher

Oh, I think I'll have a hybrid.

Martin

Anything else to add to this session? OK. We have a switchover of our next panel. My panellists here, thank you very much for your time. They're here for most of the session so thank you.
